

A SYNOPSIS OF THE GENUS TRACHUSA WITH NOTES
ON THE NESTING HABITS OF *T. PERDITA*
(Hymenoptera, Megachilidæ)

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The genus *Trachusa* Panzer¹ is represented by but three properly authenticated species, one from Eurasia, one from California, and one from Arizona. The additional names (all of Old World species) included in *Trachusa* have been long unrecognized, and are probably either synonyms of the well-known *T. byssina* or representatives of other genera, as indicated in part by Friese (1911).

Considering their widely discontinuous distribution, the three species of *Trachusa* are remarkably similar, as indicated in the following generic description.

Moderate sized, robust bees. Females almost entirely black, males with clypeus and sides of face cream-color or yellow, the lateral face marks truncate below level of antennæ; pubescence pale, rather abundant, often forming feeble bands on abdominal tergites; outer faces of the rather broad tibiæ clothed, especially apically, with characteristic, regularly placed, short, robust hairs; punctation of head and thorax, except clypeus and supraclipeal area, fine and dense; head narrower than thorax, short anteriorly; antennal bases considerably nearer to anterior ocellus than to anterior margin of clypeus; inner margins of eyes feebly converging below or subparallel; buccal fossa deep, margined by hypostomal carinæ; labrum longer than broad, subrectangular; cheeks about as broad as eye; mandibles stout, especially in females, those of male tridentate, of female with an apical tooth, followed by a notch, followed by a feeble rounded tooth which grades into a long, nearly straight edge which terminates in the strong inner apical angle; trophi rather short; labial palpi considerably shorter than glossa, first segment slightly shorter than second; maxillary palpi five segmented, second and third segments longest; thorax high; notalices linear; angle between anterior and lateral faces of mesepisternum strong; metanotum vertical, enclosure of propodeum nearly so and large; arolium present; claws of male cleft, of female with large, median, internal tooth; wings, brownish; abdomen rather short and strongly convex above, first tergite bearing a broad basal concavity; sternites two to five of female with a scopa; abdomen of male with seven exposed tergites and

¹The name *Trachusa* Panzer is here used on the assumption that the "Erlangen list" will be disregarded. As pointed out by Morice and Durrant (Trans. Ent. Soc. London, 1914: 426, 427), *Stelis* becomes a synonym of *Trachusa* Jurine, and *Diphysis* Lepeletier must be used in place of *Trachusa* Panzer, if the "Erlangen list" is accepted.

six exposed sternites, seventh and eighth sternites concealed above sixth; male genitalia with cardo broadest ventrally, reduced to a narrow ribbon dorsally; coxopodites broadest basally, bearing ventrally, near bases, the volsellæ; parameres slightly exceeding coxopodites, not united by a sclerotic bridge.

KEY TO THE SPECIES OF TRACHUSA

Males

1. Mandibles largely yellow; sixth and seventh tergites simple, without subapical folds or ridges.....*byssina*
- . Mandibles black; sixth tergite with transverse subapical keel or carina, seventh with a variously modified subapical fold.....2
2. Sixth tergite with posterior margin evenly rounded; mandible with distance from end of apical tooth to end of second tooth greater than distance between apices of second and third teeth*perdita*
- . Sixth tergite with posterior margin produced and subtruncate medially; mandible with distance from end of apical tooth to end of second tooth less than distance between ends of second and third teeth.....*manni*

Females

1. Sixth tergite simple.....*byssina*
- . Sixth tergite with strong basal elevation, separated by vertical or overhanging fold from produced, flange-like margin....*perdita*

TRACHUSA BYSSINA (Panzer)

Apis byssina Panzer, 1798, Faun. Ins. German., 5:56.

Trachusa serratulæ Panzer, 1805, Faun. Ins. German., 8:86.

Megachile resinana Schilling, 1829, Ubers. Arbeit. schles. Ges. f. vaterl. Cultur, i. J, p. 75.

?*Diphysis Pyrenaica* Lepeletier, 1841, Hist. Nat. Ins., Hymen., 2:308, female and male.

Megachile rotundiventris Perris, 1852, Ann. Soc. Linn. Lyon, 1:196, male and female.

Trachusa serratulæ var. *seitzi* Cockerell, 1925, Entom., 58:158, ♂.

Male: Mandibles largely yellow, apex of median tooth equidistant between apices of other two teeth; facial markings yellow; face not elevated along line of upper margin of clypeus; stigma longer than broad; second recurrent vein meeting or basad to second transverse cubital; posterior basitarsi broadest medially; enclosure of propodeum impunctate or only narrowly punctate above; posterior margins of tergites feebly depressed; sixth tergite with posterior margin furnished with a broad, rounded, apical flange medially; seventh tergite feebly and broadly emarginate apically, not carinate; third sternite with posterior margin concave medially and margined by long hairs; fourth and fifth sternites also

emarginate medially on posterior margins; sixth sternite with two, broad, apical, lateral lobes, separated by a broad, truncated emargination, each of the lobes furnished with a shining, impunctate, longitudinal ridge which extends nearly to the base of the exposed portion of the sternite; genital coxopodites greatly broadened basally, slender and simple apically; parameres not meeting basally, converging apically. Length 10 to 11 mm.

Female: Similar to male except for the usual sexual characters; clypeus with two or three denticles on each side of middle; fifth and sixth tergites simple. Length about 11 mm.

Among specimens before me from Germany and Austria, several different combinations of the slight venational characters upon which the variety *seitzi* is based are presented. This species has an extensive range from the Pyrenees eastward through central Europe and far into Asia.

Several of the works referred to in the preceding synonymy have not been available to me.

TRACHUSA MANNI Crawford

Trachusa manni Crawford, 1917, Proc. Ent. Soc. Wash., 19:167 ♂.

Male: Mandibles black, apical tooth slender and curved, its tip closer to tip of median tooth than latter is to tip of third tooth; facial marks lemon yellow; clypeus without transverse ridge at upper margin and without longitudinal median, impunctate ridge; second recurrent vein interstitial with second transverse cubital; enclosure of propodeum with broad, punctate band above; posterior margin of sixth tergite with median, produced, subtruncate, apical flange as broad as the median interruption in the subapical, strongly raised carina, which curves anteriorly at the sides, this carina not provided with a median, apically directed, projection; seventh tergite with longitudinal median carina basally, and a strong subapical fold, which is greatly produced laterally near the apex as a broad lobe on each side, forming a wide, deep, median emargination in what appears to be the posterior margin of the tergite; true posterior margin of tergite slightly beneath this fold, and with a shallow median emargination as broad as the emargination in the subapical fold; apical portions of third, fourth, and fifth sternites densely pubescent, apical margin of sixth with a subtriangular, median projection. Length 14 mm.

The type specimen is in the United States National Museum. This species is known only from the two original specimens from Ramsey Canyon, Huachuca Mountains, Arizona. Since I have not seen this species, the preceding descriptive comments have been taken from Crawford's paper and from notes on the type sent by Miss Grace A. Sandhouse.

TRACHUSA PERDITA Cockerell

*Trachusa perdit*a Ckll., 1904 Bull. So. Calif. Acad. Sci., 3:159 ♂.

Male: Mandibles black, apical tooth rather broad, its tip farther from tip of second tooth than the latter is from third; facial markings cream color; face elevated along line of upper margin of clypeus, and clypeus with a longitudinal, median, impunctate ridge; stigma of fore wings broader than long; second recurrent vein distad to second transverse cubitus; enclosure of propodeum with broad, punctate band above; posterior basitarsi slender and parallel sided; posterior margins of abdominal tergites strongly and abruptly depressed; sixth tergite with posterior margin broadly rounded, the entire margin (instead of median part only as in other species) produced as a flange which is delimited basally by the subapical, transverse, feebly nodulose keel, which curves anteriorly at the sides and gives off medially a short, subtriangular projection or keel toward the posterior margin of the segment; seventh tergite with longitudinal median ridge basally, and a subapical transverse fold which is not greatly produced and which might appear to be the apical margin of the segment only laterally, because the median and most strongly elevated portion of the fold is strongly arched anteriorly so that it is, at the midpoint, nearer to the base of the exposed portion of the tergite than to the apex; area distad to and enclosed in the arch of the fold smooth, depressed, and brown; posterior margin of seventh tergite narrowly and rather feebly emarginate medially; third and fourth sternites with margins slightly produced posteriorly in the middle, not provided with long hairs; fifth sternite similar but with weak, median emargination in produced portion; sixth sternite broad, feebly three lobed at apex, lateral lobes low and subtruncate, at extreme sides of sternite; median lobe more elevated, exceeding lateral lobes, truncate, and furnished with a pair of large, strongly anteriorly directed teeth at its apex which form a U-shaped emargination; seventh and eighth sternites heavily sclerotized, seventh with posterior margin furnished with a broad, V-shaped median emargination, eighth rather elongate, broadened posteriorly to the trilobate apex, median lobe longer and broader than lateral lobes, its apex slightly emarginate; genital coxopodites not much broadened basally as seen from above, apically with small, blunt, external tooth and transverse subapical ridge; parameres contiguous (but not fused) in basal halves, slender and widely separated apically. Length 11 to nearly 13 mm.

Female: Black, with whitish pubescence, forming bands on posterior margins of abdominal tergites one to five. Head, except for clypeus and supraclypeal area, finely and closely punctate; clypeus and supraclypeal area rather coarsely punctate, the region of the suture separating these sclerites, and the median longitudinal line of the clypeus somewhat elevated and not punctate, although dull; anterior margin of clypeus with about eight or nine

small denticulations; hypostomal carinae more strongly elevated than in *byssina*; enclosure of propodeum punctured above, impunctate but minutely tessellate below (punctate band broader than in *byssina*); abdominal tergites rather similar to those of male in punctation, with posterior margins conspicuously and rather abruptly depressed and more closely punctate than rest of tergites, these depressed margins broader than in the male; fifth tergite with posterior margin feebly and broadly emarginate medially; sixth tergite with large, median, basal, strongly and abruptly elevated area, produced medially and apically to a small, overhanging point; posterior margin of sixth tergite produced medially as a broad, rounded, horizontal shelf or flange; ventral scopa long and dense. Length nearly 13 mm.

Neallotype, female, No. 4845, Calif. Acad. Sci., Ent., Hastings Natural History Reservation, near Jamesburg, Santa Lucia Mountains, Monterey County, California, 1800 feet elevation, June 14, 1938, on *Brodiaea ixiodes* (C. D. Michener). The type specimen is from Tehachapi, California, and is in the American Museum of Natural History, New York City.

Although apparently rare, this bee proves to be rather widely distributed in southern and central California, as indicated by the following additional localities: The Gavilan, Riverside County, May 31, 1937, on *Pentstemon antirrhinoides* (P. H. Timberlake); Santa Barbara, May 7, 1936, on morning glory (I. McCracken).

The female of this species, previously known only from the unique male type, is here described for the first time.

On June 14, 1938, at the Hastings Natural History Reservation, I had the opportunity to observe briefly the habits of *Trachusa perdita*. About a dozen nests were found, all in the ground on one hillside (the only place on the Reservation where any individuals of this species were seen). There was a tendency toward grouping of the holes, all those seen being disposed in groups of two to four, the individual holes of a group being from eight inches to two feet apart. They were in loose, somewhat sandy soil, the surface of which sloped in a southerly or westerly direction at an angle of 20° or 30° from horizontal. No turrets or piles of earth marked the entrances, which were left open and unguarded when the females left to visit flowers. The holes were about ten mm. in horizontal diameter, slightly less in vertical diameter, and slanted downward throughout their courses at angles of 20° to 30° from the horizontal. In the five nests which

were opened, the tunnels, which were five or six inches long, bent strongly to one side in a broad curve, which, in one case placed the bottom of the tunnel almost directly beneath its entrance.

The cells were placed end to end in the lower part of the tunnel, and were rather firmly glued together, so that an entire series of them could be removed unbroken. The intercellular partitions were thin, there being no thick resinous plugs, such as those shown by Hachfeld (1926) for *T. byssina*, between cells. Outside dimensions of the cells averaged 16 mm. in length by 10 mm. in diameter. Cells were made from irregular pieces, commonly two or three times as long as broad, cut from the serrate margins of the thick leaves of the shrub, *Rhamnus crocea*, which grew nearby. These pieces were arranged with their long axes at right angles to the long axes of the cells, and cemented together to form firm walls by means of a gum which was sticky at the time of excavation but became very hard after a few months in a vial. Although this gum burned vigorously, seemingly with the odor of pine pitch, there were no conifers within two miles of the nesting site. It caused adherence of numerous small pebbles and particles of sand to the outside of the cells. Although possibly carried in by the insects, these objects were in all probability *in situ* in the soil.

One nest excavated contained a single incomplete cell, half full of a stiff, sticky, brown substance, the pollen of *Brodiaea ixiodes*, which was the flower visited chiefly by these bees at this locality. Other nests were more nearly complete, the one with the largest number of cells having, however, but four. The uppermost cell of this nest was incomplete and unprovisioned, in the process of being built, but the others contained fully grown larvæ, which had consumed all of their food. This suggests that the process of nest building and provisioning is slow, although that of larval development may be rapid.

A number of cells were placed in vials, and opened from time to time during the next year. The fully grown larvæ eventually enclosed themselves in tough, brown, parchment-like cocoons, and remained thus, as prepupæ, throughout most of the winter. In early June, 1939, one passed through a brief pupal state and emerged as an adult, cutting an opening through the side of its cell, but the few others still alive remained as prepupæ within their cocoons, and would have emerged the following summer, perhaps, had they not been killed.

The cocoons were similar to those of *Osmia*, with a large, solid, well formed nipple in the middle of a deep concavity or chamber at the anterior end. This cavity was formed by a thin sheet extending anteriorly from the side walls of the cocoon along the inner surface of the cell. Hachfeld shows this chamber closed in *T. byssina*, but states that the sheet which forms it is easily broken. Such may be the case in the cocoons before me, in all of which the chamber is broadly open anteriorly. Laterally, the sheet which forms the anterior cavity is supported by several, thin, rather irregular lamellæ connecting it with the anterior end of the cocoon proper. This is quite a different structure from the three, regularly placed, concentric rows of supporting strands, not confined to the lateral parts of the chamber, described and figured for *T. byssina* by Hachfeld.

As may be seen from the preceding notes on *Trachusa perdita*, its habits differ considerably from those of *T. byssina*, which have been described in some detail by several European authors. The latter species, according to Friese (1911, 1923), nests in groups of as many as forty or fifty females, and the tunnels do not have the unusual shape described for those of our species, but may be branched. However, as in *T. perdita*, the cells are made of pieces of leaves, stuck together by gum (in the case of *T. byssina* at least, pitch from pine).

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